

ENRICO TORTONESE (*)

REMARKS ON THE MORPHOLOGY AND TAXONOMY
OF *OPHIODERMA LONGICAUDUM* (RETZ.)
FROM THE MEDITERRANEAN

(*Echinodermata Ophiuroidea*)

Abstract. — Several characters of *Ophioderma longicaudum* express the variability of this species: radial shields (naked or covered by granules), dorsal arm plates (entire or fragmented), shape of the oral shields and the ventral arm plates, colour. Naked radial shields have been observed chiefly in the specimens from southern areas. Differences of colour are somewhat connected with ecological conditions. The size smaller than in the «forma *guineense*» (tropical eastern Atlantic) may prove a latitudinal cline. *Ophioderma cinereum* (western Atlantic) is very similar but the supposed conspecificity is not confirmed after the present comparison.

Riassunto. — *Note intorno alla morfologia e tassonomia di Ophioderma longicaudum del Mediterraneo (Echinodermata Ophiuroidea).*

Diversi caratteri di *O. longicaudum* esprimono la variabilità di questa specie: scudi radiali (nudi o coperti di granuli), piastre brachio-dorsali (intere o divise), forma degli scudi orali e delle piastre brachio-ventrali, colore. Scudi radiali nudi sono stati osservati soprattutto in individui di zone meridionali. Le differenze di colore sono alquanto legate alle condizioni ecologiche. Le dimensioni inferiori rispetto a quelle della «forma *guineense*» (Atlantico tropicale orientale) attestano forse un gradiente latitudinale. *Ophioderma cinereum* (Atlantico occidentale) è molto simile, ma la supposta conspecificità non trova conferma nel presente confronto.

Ophioderma longicaudum (Retz.) is a large Mediterranean ophiuroid found at about 0-100 m on rock and stony bottoms, in posidonia and algal beds, also on mud and in coralligenous ambient. The horizontal distribution includes the whole Mediterranean and the eastern Atlantic from Britain to Portugal, Azores and African coasts to Angola; maybe it can be found as a stray along all the southern coast of the Channel, being however unknown at Roscoff.

(*) c/o Istituto Zooprofilattico, Lungo Bisagno Dalmazia 45 A, 16141 Genova (Italy).

A closer study of its morphology and variations has been stimulated by recent comparisons of different *Ophioderma* including *longicaudum* and some species from the American seas. The treatment of the former in ZIESENHENNE's review (1955) was found unsatisfactory (he had a single specimen). According to the key published by this author, the following features would be expected, as leading to the identification of this Mediterranean species: 1. Upper arm plates divided. 2. Radial shields normally exposed. 3. Arms spines 8 or more. 4. Arm length 4,5 times the disc diameter. 5. Arms not banded. But the characters 1, 2, 5 are actually very variable and 4 requires a correction, as the value is 4-6. The purpose of the present note is a clarification of these matters.

A total of 42 specimens (writer's collection) has been examined. They are from the following Mediterranean localities: Genova (2) - Levanto, gulf of Genova (1) - S. Michele, id. (2) - Noli, id. (3) - Alassio, id. (1) - Leghorn (3) - Guf of Naples (12) - Is. Ischia, id. (1) - Capo Testa, Sardinia (1) - Taranto (6) - Capo Peloro, Sicily (2) - Messina, id. (2) - Catania, id. (1) - Monaco (4) - Atlith, Israel (1).

Maximum total diameter about 280 mm; maximum diameter of the disc about 25 mm; length of arms 4,5-5,5 the disc diameter (exceptionally 6): very often it is slightly different in the same specimen.

This species has been often dealt with in the faunistic literature (KOEHLER, 1924; NOBRE, 1930; TORTONESE, 1965) but the descriptions are mostly short and few details are reported concerning the morphological variations. However, the latter are easily noticed and some reach a remarkable degree as shown by the present analysis in which the following abbreviations are used: *DD* diameter of disc (mm). *A/D* length of arms/diameter of disc. *RC* radial shields covered by granules. *RN* radial shields naked. *DE* dorsal arm plates entire. *DF* dorsal arm plates fragmented. *AS* number of arm spines on the basal fourth of the arms.

No very young specimens are available. In those with *DD* less than 10 mm MADSEN (1970) observed naked radial shields, granulated oral shields, entire dorsal arm plates, only 6-7 arm spines. The smaller *Ophioderma* at hand (*DD* 10-19 mm) have the main characters listed below. The colours are omitted because their kinds and patterns are similar to those described later on.

- DD 10 - A/D 4,5 - RC - DE - AS 7-8
- DD 12 - A/D 4 - RC - DE - AS 6-8
- DD 14 - A/D 5 - RC - DE - AS 7-9
- DD 14 - A/D 3,8 - RC - DE (some DF) - AS 7-8
- DD 16 - A/D 5 - RC - DE (some DF) - AS 9
- DD 17 - A/D 4,6 - 3 RC, 7 RN - DE (some DF) - AS 9
- DD 17 - A/D 4,5 - RC - DF - AS 9

DD 18 - A/D 5 - RC - DF - AS 10
 DD 19 - A/D 5,5 - RC - DF - AS 10
 DD 19 - A/D 4,5 - RN - DE and DF - AS 10
 DD 19 - A/D 4,5 - RC - DE (almost all) - AS 10
 DD 19 - A/D 4,2 - RC - DF (almost all) - AS 8-10

No remarkable changes occur in the general appearance during the further growth. However, the value of A/D increases, the dorsal arm plates become more fragmented and the number of arm spines is higher. A series of about 30 adult specimens (DD 20-25 mm) is considered for the evaluations of five characters.

1. *Ratio A/D* - The usual value is 4-5,5. A single specimen (Catania; DD 20 mm) has $A/D = 6$, a maximum that can be held to be very rare at least in the Mediterranean. It must be noted that the arms are often slightly unequal and that in such cases the longest is measured.

2. *Radial shields* - Their oval shape may differ and sometimes is less regular. Also the size and the interval in each pair are slightly variable. The shields may be all covered by granules (and therefore wholly hidden) or all naked; both conditions often exist in single specimens, with different proportions. Sometimes only a small central area is naked. Out of 29 specimens I noticed 21 (72,4%) with more than 50% RC, 8 (27,5%) with more than 50% RN. One or the other condition seems to prevail in each population sample, e.g.:

Gulf of Genova (9 specimens): all RC.

Naples (7 specimens): 2 RC and 5 RN (71,4% RN).

Taranto (5 specimens): 4 RC and 1 RN (20% RN).

As a whole, naked radial shields (all or some) are present in 11 of my specimens, 10 of which are from south of 41° lat. N. Shields all naked are shown by some specimens from Naples, one from Taranto and one from Israel. They are also evident in the photos of *O. longicaudum* from Cyprus (DEMETROPOULOS-HADJICHRISTOPHOROU, 1976, pl. 57-59). Naked shields may be more frequent in the southern areas of the Mediterranean.

3. *Dorsal arm plates* - Entire and fragmented plates are commonly observed in the same specimen and one or the other condition may prevail. Out of 27 specimens, 23 (85,1%) have chiefly DF, only 4 (14,8%) have chiefly DE. Often there is a single division, placed along the middle line of the plate or not. Division in 3-4 parts is also frequent. It may be increased so that the sections are 6-8, of different size and form; the smaller are interposed among the larger ones. In such cases the dorsal surface of the arms is like an irregular mosaic continuous on many

segments and obscuring their limits: this is chiefly seen in large specimens but also some of good size may have plates entire or little fragmented. The « mosaic condition » reminds the genus *Ophioplocus* (Ophiuridae), in which it is normal.

4. *Ventral arm plates* - Their distal edge is straight or slightly convex or concave; sometimes it is rather irregular (undulated). A small median notch is often present.

5. *Oral shields* - The form is very variable, often in the same specimen. Generally it is triangular with rounded angles; height and width may be equal or not: asymmetry is frequent. The lateral edges may be concave and the outer may be undulated with small lobes and notches. The different shapes of the oral shields and of the ventral arm plates are only individual variations, not at all connected with localities.

6. *Colour* - The simplest condition is observed in the specimens living on the rocks near shore (infra- and also mediolittoral levels): disc uniformly dark brown or black, grey on the oral side, arms with rings not very evident or absent. Brighter colours and patterns on the disc and the arms exist in specimens found in other, commonly deeper biotopes. The following details are shown by the available material.

On the disc are often scattered darker or lighter spots, more or less minute. Patches or irregular clear lines may variegate the aboral side, the central part of which may have one or more patches, unequal and well evident, surrounded or not by light spots. More rarely, the central patch is yellowish-white with black borders. Darker rings on the arms are very frequent and differ for their number, extension, intensity. They may be restricted to the distal part of the arms or at least be more evident there; rings may exist along the whole arm, covering 2-6 segments (in the latter case are longer than the intervals). Sometimes they extend (paler) on the ventral side. Even dorsally, they may be rather indefinite and the arms appear variegated because many dark and light spots and small patches are added or replace the rings. Often a series of white spots is along the distal edge of the dorsal arm plates. White and irregular small patches may occur on the sides of the distal part of the arms. More rarely, two dark lines, not continuous, are along the sides near the edges of the dorsal plates.

A specimen from Taranto (DD 23 mm) is exceptional being wholly clear grey (preserved) with many well marked black patches on the disc and the arms. Black, brown and grey pigmentation is well kept in the preserved material and all the patterns are persistent.

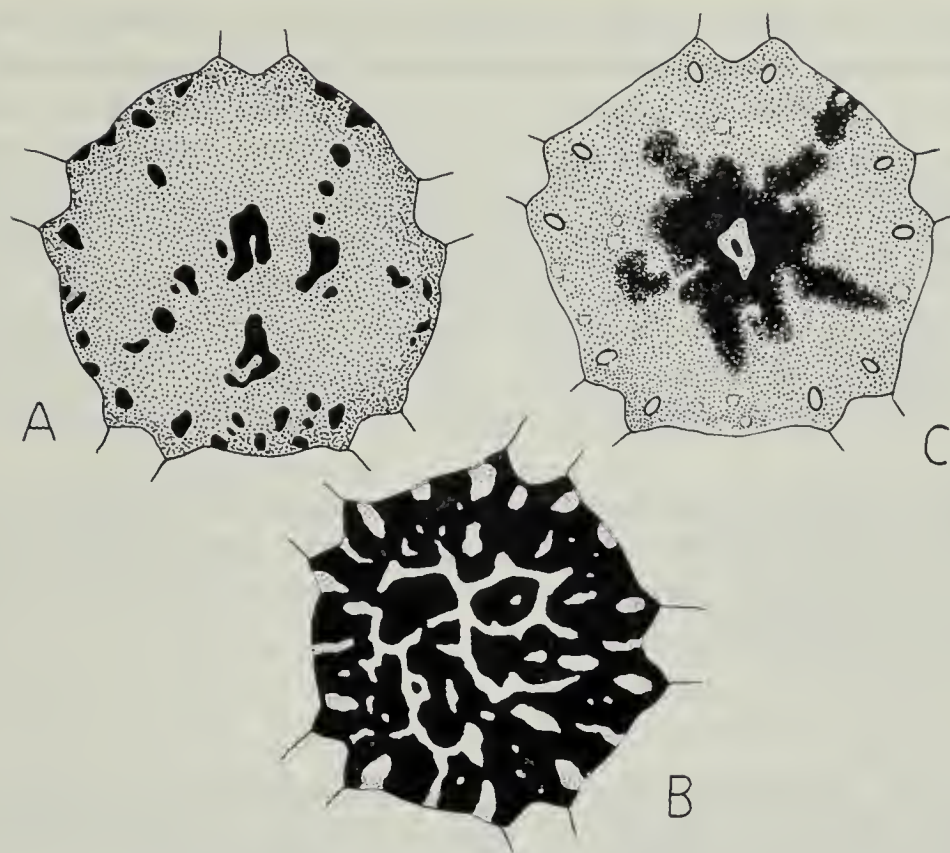


Fig. 1. — *Ophioderma longicaudum* (Retz.). Aboral side of disc. A, Taranto (DD 23 mm). B, Alassio, gulf of Genova (DD 14 mm). C, Naples (DD 19 mm).

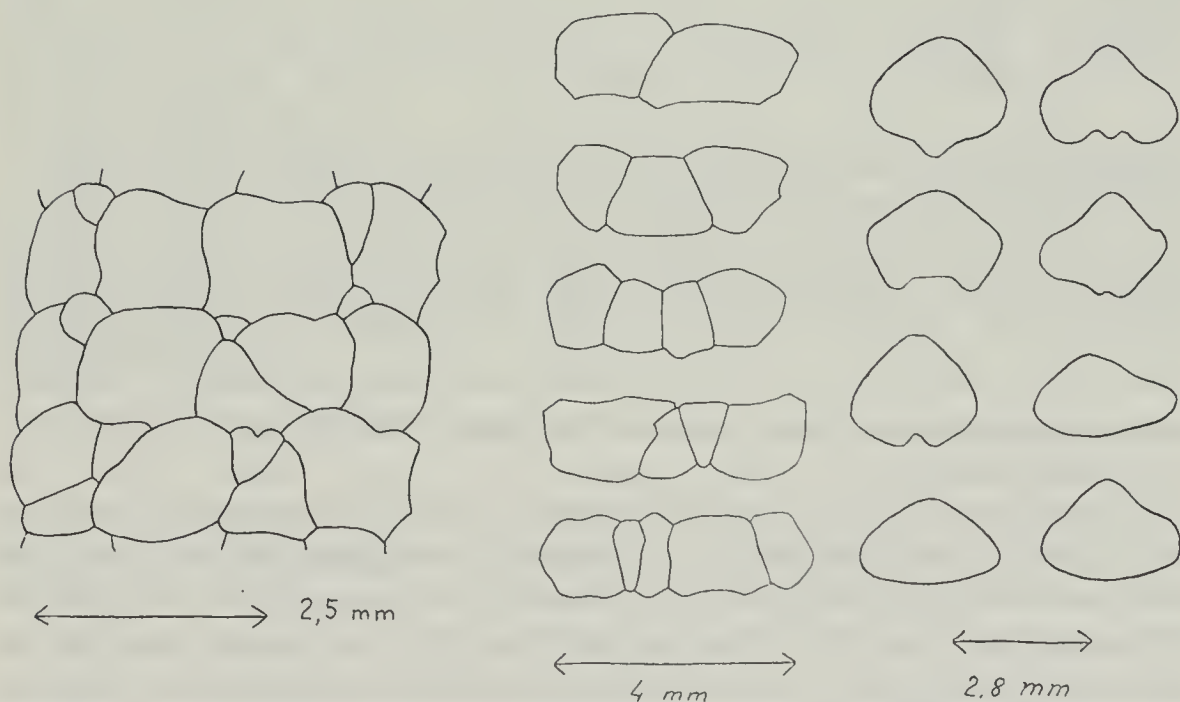


Fig. 2. — Dorsal side of some proximal segments of an arm (Specimen from the gulf of Naples) (left). - Dorsal arm plates (centre) and oral shields (right) of different specimens.

At Tripoli (Lybia) I found on gravel (15 m) some *Ophioderma* pale reddish with many brown spots and irregular lines on the disc and rings on the arms. At Beirut (Lebanon) I collected others (on stony bottom with algae, 8-10 m) showing different colours, usually rather pale (brown, grey, often red on the oral side), disc with pale or dark spots and lines, arms always ringed, also ventrally or not. MARCHISIO (1896) in Posidonia beds (Gulf of Genova) found specimens brown with red spots on the arms; those from deeper bottoms (25 m) were brownish red aborally with greenish spots on the disc and the arms, red orally. Also CONDORELLI (1899) noticed similar beautiful colours in specimens from 30 m in Adriatic.

A quite surprising coloured figure has appeared (STRENGER, 1963, pl. 7): disc yellow greenish, arms with white and green rings. Such an ophiuran reminds the *O. appressum* that I collected in Florida and surely has nothing to do with *O. longicaudum*.

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After the preceeding review of several characters of *Ophioderma longicaudum* and their variations, short taxonomic remarks are to be added, involving some Atlantic forms of the same genus.

As it was said above, this Ophiuroid is present not only in the Mediterranean but also along a wide section of the Eastern Atlantic shores. GREEFF (1881) described *O. guineense* from the gulf of Guinea (Is. San Thomé, is. Rolas) having A/D 5-6, radial shields covered by granules, 9-11 oral papillae, 12-14 arm spines, colour blackish or dark brown, arms with or without rings. KOEHLER (1907, 1909) recognized typical representatives of *longicaudum* in specimens from Canary islands, Dakar and Congo, and later (1911) supposed that this species shows morphological changes proceeding southwards along the African coasts, passing gradually to the « form *guineense* »: the dorsal arm plates would become less and less fragmented. The same author (1914) then examined GREEFF's types and confirmed his previous statements about the specific identity *longicaudum-guineense*, later accepted by other echinologists (A. M. CLARK, 1955; MADSEN, 1970).

Having no material from West Africa, I can only say that after the data found in the literature the tropical population differs from the northern one (Mediterranean, etc.) because a greater size is attained (DD to 30 mm, total diameter to 440 mm) which of course involves an increase in the ratio A/D (up to 6) and in the number of arm spines (up to 14). However, it may be added that at present no valid reasons exist for admitting a subspecific separation, expressing a clear geo-

graphic divergence. Possibly the size regularly increases toward the warmer regions so that a clinal, latitudinal variation occurs along the western African coasts.

O. cinereum Müll. Trosch. is a related species, perhaps identical according to MADSEN. It is common in the western Atlantic from Bermuda and Florida to Brazil. In the ZIESENHENNE's key it is opposed to *longicaudum* because the ratio A/D is 3,5 instead of 4,5 and the arms have rings. Only a few specimens are available to me and the data supplied by recent authors (TOMMASI, 1970; CASO, 1979) are not wholly helpful for an adequate comparison of these two species. Three of my *cinereum* are from Vera Cruz, Mexico (DD 16-25 mm), one is from « Antilles » (DD 17 mm). A/D is about 4 in all of them. Radial shields are always naked, oval and rather large. Between those of each pair there are 2-3 smaller naked plates (only one in the smaller specimen). The dorsal arm plates are very fragmented, never entire. All these features are said to be constant in *cinereum*. Concerning the arm spines (8-12), tentacle scales, oral shields and oral papillae I cannot detect differences from *longicaudum*: maybe they will appear after the study of larger and possibly fresh samples. The arm rings on the arms are absent or not very evident in my Mexican specimens (dry), but well apparent in that (much older) from Antilles: they occupy 1-2 segments and are dark brown, extended (paler) also ventrally; many white spots are on them and also on the intervals, black spots are scattered on the disc. This is a species of large size (DD reaching 35 mm) and with short arms (A/D about 4). Usually the latter have rings, but « dark coloured specimens are often unicolor » (H. L. CLARK, 1933).

The naked plates on the disc between the radial shields and the shorter arms separate *cinereum* from *longicaudum*. The radial shields always naked, the dorsal arm plates always well fragmented and the arms generally ringed are other characters of *cinereum*. I prefer to keep these Ophiuroids as specifically different, just as they are well separated geographically.

Ophioderma, like *Echinaster*, is a genus much better represented in the western Atlantic than in the eastern. Beyond *O. longicaudum*, some authors recorded near Africa *O. appressum* (Say), which in the American waters is widespread from Bermuda and South Carolina to Brazil. Quoting the African reports, MADSEN (1970) suspected confusions with *longicaudum*. Many years ago I received by G. Thorson (Copenhagen) a small undetermined *Ophioderma* from Los Christianos, Teneriffa (Canary is.), collected at 20 m among algae and corals. DD 6 mm, A/D about 3; colour white, arms with wide (4-5 segments) rings, perhaps

green in life. The adoral plates are covered by granules as stated for *O. appressum* by ZIESENHENNE and as I also find in adult specimens from Antilles (Is. S. Thomas). Quite probably the specimen from Teneriffa is an *O. appressum*, a species that to my knowledge has not been reported from the Canary islands (where *O. longicaudum* is present).

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